THE DEVELOPMENT AND APPLICATION OF REGIONAL PROJECTIONS: BALANCING POLICY CONCERNS AND TECHNICAL FACTORS

Stanley R. Hoffman and Rune Carlson

Association of Bay Area Governments
Hotel Claremont
Berkeley, California 94705

Robert E. Goldman

Office of Science and Technology
Executive Office of the President
Washington, D.C. 20007

Presented at the
American Institute of Planners
61st Annual Conference

September 27 - October 1, 1978
New Orleans, Louisiana

ABSTRACT

Producing regional projections is a complex technical process, but because of their application in public investment decisions, it inevitably becomes a complex policy process. For the past three years, the Association of Bay Area Governments (ABAG) has been involved in a process to develop regional projections of population, housing, employment and land use for the San Francisco Bay Region which balances policy concerns and technical factors. First, the technical aspects of the projection system and the underlying assumptions are outlined. Second, the process is described which resulted in a major cooperative effort between local and regional agencies in developing the policy based projection assumptions. The ABAG concept of using a range of projections to deal with uncertainty surrounding public investment decisions is then contrasted with the traditional approach of using a single baseline projection. Finally, the use of this concept is illustrated by the development of a twenty-year sewage treatment plant project list for the region and policy testing in the development of an air quality maintenance plan.

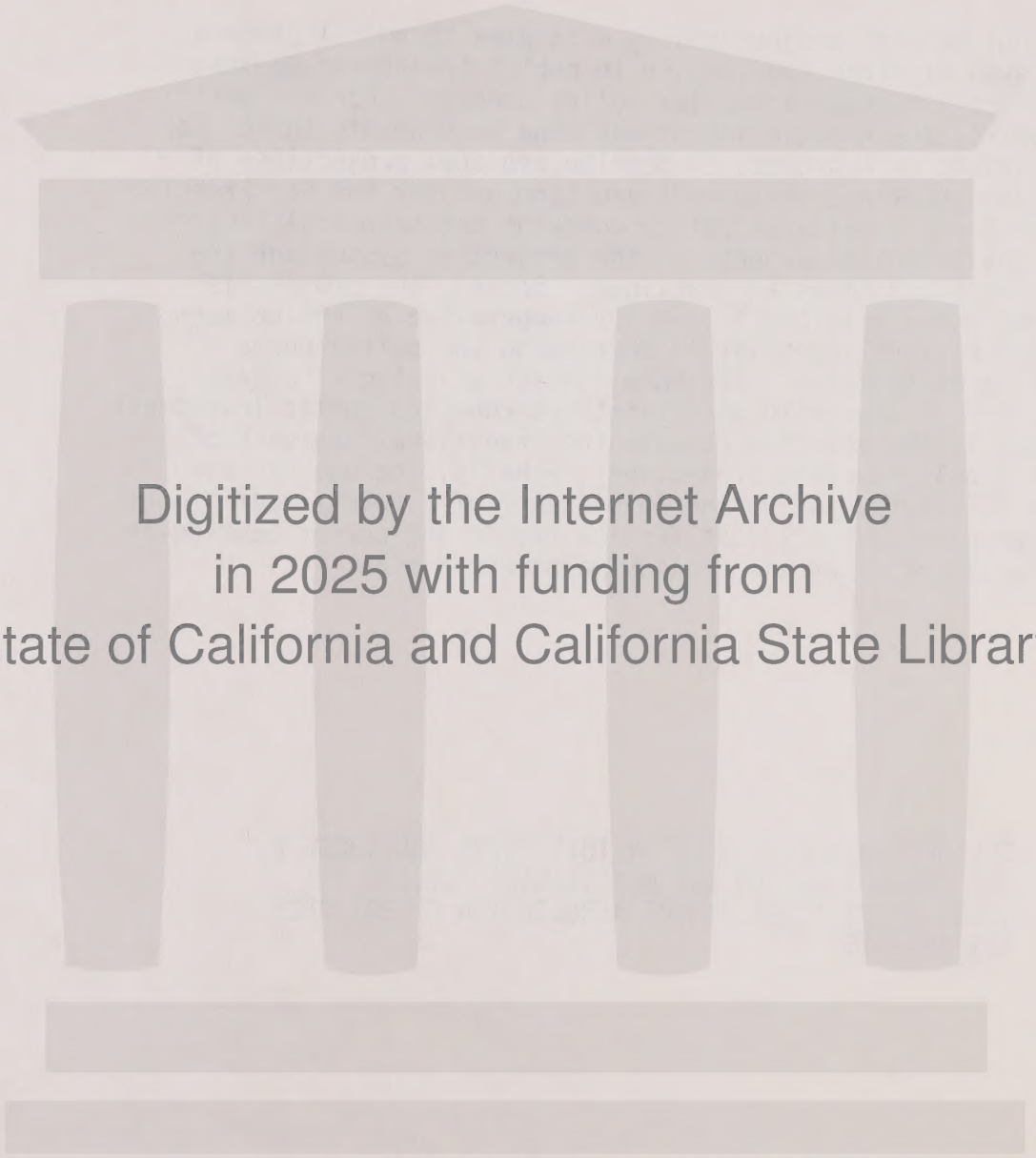


TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Producing long range demographic, economic and land use projections is a demanding technical process, but because of their application in public investment decisions, it also becomes a complex policy process. For the past three years, the Association of Bay Area Governments (ABAG)* has been involved in a process to develop regional projections of population, housing, employment, and land use for the San Francisco Bay Region. This process balances policy concerns and technical factors. This paper describes the process:

- from the conceptual approach;
- through the development and adaptation of a technical system;
- to applications in formulating regional environmental policy;
- while stressing procedures for local participation to balance policy concerns with technical factors.

The ABAG projections provide a basis for problem identification and policy formulation. They are structured so as to focus the discussion on the policy and technical factors that influence the growth of the region. This role has been strengthened recently by the formulation of urban development strategies by the Governor of California's Office of Planning and Research which mandate the use of projections approved by regional councils of governments, such as ABAG, in all statewide programs, particularly those that influence funding allocations. But this role is not without difficulties because of the uncertainty of future conditions and policies, and it will require coordination with a multitude of jurisdictions and organizations, as well as a regular monitoring and updating of the projections.

An earlier version of the projection system was first applied in the region under the auspices of the Bay Area Transportation Study in the mid-1960's. After substantial model and data refinements, ABAG and the Metropolitan Transportation Commission (MTC) jointly applied the system in 1972 to produce the Series 1 regional projections for the Regional Water Quality Control Board. With some additional refinements, in 1973 the ABAG/MTC Joint Planning Program produced the Series 2 regional projections which were used in the Regional Transit Travel Projections Project and for other regional planning applications. Series 3--the latest set of projections--were produced in March, 1977, and have had a broad range of regional applications, including environmental management, housing, health, and transportation. The Series 3 projections mark a departure from earlier projections by ABAG in the conceptual approach and the process by which they were developed and applied.

*ABAG is the areawide comprehensive planning agency for the nine-county metropolitan region surrounding the San Francisco Bay. It is the federally-designated clearinghouse for the review of Federal grants. ABAG operates as a voluntary association of cities, counties and other cooperating agencies in the Bay Area.

First described is the conceptual approach that provided the framework for the development of the projections and their use in policy testing. A key feature was the development of a range of projections to deal with the uncertainties of non-policy factors influencing economic and population growth (e.g., fertility rates) as they affect public investment and policy decisions. The assumptions underlying the range were selected to bracket plausible regional futures. Later testing explored the effects of altering these technical and policy assumptions.

The analytical components of the projection system and the underlying assumptions are described next. The system consists of a set of integrated mathematical models--economic, demographic, and land use--for producing regional and subregional projections. The importance of consistency of assumptions and data bases is stressed.

The process of local participation and public review was crucial to the development of both policy and technical assumptions. The primary mechanisms for facilitating participation are described. These included the formation of a Projections Technical Advisory Committee and contractual arrangements with each of the nine Bay Region counties to supply information on land development and service provision policies.

Finally, the development and application of the projections are described. Two specific environmental planning applications are used to illustrate how the process worked from concept to practice. The paper concludes with some observations on the utility of models for regional planning and ways to improve the process based on ABAG's experience.

THE CONCEPTUAL APPROACH

There have been two dominant views of the use of projections in regional planning and policy analysis at ABAG. The first view emerged from ABAG's traditional planning paradigm of the late 1960's--optimal end-state planning. The more contemporary view--the policy analytic approach*--is still emerging, partly from the incremental planning perspective, but more significantly from the policy management concept as reflected in ABAG's Environmental Management Program. It can be characterized as anticipating the future consequences of present planning actions or policies. The optimal end-state approach used projection systems--frequently models--to quantify the size and shape of the desired future at one point in time, so as to estimate the public service needs associated with that "comprehensive plan." The policy analytic approach also uses projections--again, with or without models--in order to guide the political action process by estimating the consequences of a selected set of planning policies or actions.

These views on projections are related to widely different notions about what the planning process is or should be about and what the appropriate role of the staff planner is in that process. While the framework and process described in this paper reflect a particular point of view on such issues, it is not the intention here to compare and debate alternative views of the process or the planner's appropriate role. It is, however, important to acknowledge the existence of such differences, because these differences arose throughout the course of implementing the approach described in this section. Frequently disagreements both inside and outside ABAG regarding projection issues related not to the specific technical issues being debated but rather to fundamental issues about the planning process, such as the desire to view one quantified end-state plan.

Key to the ABAG use of the policy analytic approach was the starting concept of planning as a process, with the projections viewed as indicators of future conditions rather than as an end product. The projection systems improve our ability to anticipate consequences of current policy actions that are premised on modifying future development trends in desired ways. The intent here is to place the development and use of projections not only within the technical planning process, but also within the political decision-making process.

This concept had some important implications. The technical planning process and the political decision process had to be closely intertwined and these processes had to consider all the important institutions which have the power to significantly affect future trends. It further implied that the process should incorporate a knowledge of the causal chain of events.

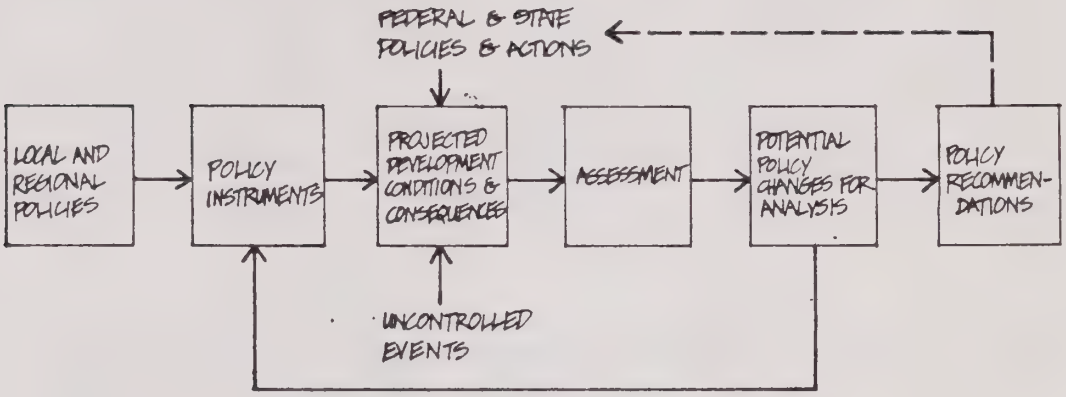
---

*This conceptual approach was first presented by Goldman at the University of Pennsylvania, Conference on Use of Models, October 1975.

The figure below presents the framework within which the ABAG projections effort proceeded.

Figure – 1

OVERVIEW OF POLICY ANALYTIC APPROACH



The conceptual diagram charts a process that placed technical projections within the context of policy formulation, analysis and recommendation. It also made the technical planning process integral to the political action process. Technical analysis should assist political action, while political action should determine needed technical analysis.

The diagram makes some basic and important distinctions. First, a distinction is made between "policies" and a "policy instruments." Roughly, a policy is a guiding principle while a policy instrument--either legal, financial or administrative--is a specific action or device by means of which a policy is implemented. An adopted general plan typically contains statements of policy. The implementation of these policies is through such instruments as zoning ordinances, public capital investments, land reserves, etc.

The framework also distinguishes local and regional policies and actions from State and Federal policies and actions that have a significant effect on local development patterns. The focus of ABAG's attention was on those actions directly under the control of regional and local agencies within the Bay Area. It is also important to distinguish between policy instruments and what are described in the diagram as "uncontrolled events." Future conditions are influenced both by policy instruments and events and forces which are uncontrolled. To some extent, the classification of certain events and conditions as "uncontrolled" was a matter of convenience. For example, the regional economy is substantially affected by Federal and State actions. For ABAG's process, they were treated as not within the the realm of policy action by local or regional agencies.

The range in assumptions about such external influences--an additional key concept not indicated in the graphic framework--led to the notion of projections defining a range rather than a single path. This notion was intended to bracket or define a "plausible" range reflecting assumptions about "uncontrolled events" such as economic growth, migration and fertility rates. This range of assumptions resulted in high and low projections for the total region termed "base cases" (as opposed to a single "baseline").

The regional high and low base case projections were then allocated to local areas accounting for their land development policies. The resulting small area projections formed the description of conditions and consequences that would result from the interplay of assumptions about a range of regional growth and local area policy instruments premised on managing that growth.

Impact assessment, in its broader aspects, provides information on the environmental, economic, social, institutional and financial effects of the policies assumed for analysis. The "assessment" stage could be viewed as the starting point of the process, insofar as it determines what technical information is needed from the projection models to identify policy conflicts. It is here that the analysis examined further consequences of the growth assumptions upon public policy objectives. Projections based upon assumption of no change in currently committed policies and actions would yield one assessment of future problems. This initial analysis could be termed "problem assessments." Subsequent analyses could be termed "impact assessments."

The "policy change" stage is the primary point where technical analysis and political review and response came together. The concept provided for a feedback loop where political response to the analysis will determine potential policy changes for re-analysis. This step is dependent upon participation by broadly based policy advisory groups and wide public review. Potential policy changes would then be fed back for re-analysis resulting in subsequent assessment of their consequences. This new round of projection and assessment is the key to providing decision-makers with information on policy conflicts which could arise from a recommended course of action.

This conceptual framework specifically recognized policy analysis as both the input and outcome of the projection process. This established the policy analytic approach in both technical and policy terms. The role of the models was made internal to the objective of policy analysis. The models were used to structure and account for a large and complex set of interrelationships. The model products, i.e., the projections, were recognized only as technical measures of the consequences of policy actions and assumptions about non-policy events. They were not recognized as policy in and of themselves. In effect, the technical workings of the modeling system serve as a fulcrum around which the analysis of existing policy on one hand and recommended policy changes on the other could proceed in an orderly manner.

THE URBAN DEVELOPMENT MODELING SYSTEM

The computer-based analytical urban development modeling system consists of four major models to project the growth and geographical distribution of population, housing, employment and land uses for the nine-county Bay Region. The system, shown in Figure 2, consists of two regional models--demographic and economic--and two subregional models--basic employment and projective land use. Projections were produced at both the regional level and for 440 subregional transportation zones at five-year intervals from 1975-2000.

The approach was to project regional control totals to the year 2000 using the regional models, and then to allocate the resultant population, households and employment, and compute the accompanying land uses using the subregional models. The level and distribution of these urban activities are influenced by the policy and non-policy assumptions which are summarized in Table 1. A key feature of the system is the consistency of data bases and assumptions among the four models.

The Regional Demographic Model

The regional demographic model is a cohort-survival model which is used to project population, households, and labor force at the regional level. The primary non-policy assumptions include fertility, mortality, migration, household headship and labor force participation rates. Since local governments have no direct influence over demographic trends, policy variables were not assumed or tested with this model. Rather, the demographic trends were selected after examining current trends and in consultation with a technical advisory committee.

The fertility rates selected ranged from a high completed fertility of 1.8 to a low of 1.5 for the region by 2000. The household headship and labor force participation rates were selected to be consistent with the fertility rates based on Census Bureau information. Initial migration rates were specified, but later adjusted to achieve consistency between the labor force and employment projections. This adjustment takes place between the regional demographic and economic models as shown in Figure 2 and will be described in more detail later. The resultant population and household control totals were then passed to the Projective Land Use Model (PLUM) for allocation to the zones.

The data base was developed mainly from the 1970 United States Censuses of Population and Housing, adjusted to 1975 using mid-decade censuses taken by a number of Bay Area counties. Where 1975 censuses were not available, estimates made by the California Department of Finance were used.

The Regional Economic Model

The regional employment projections by industry were developed for manufacturing and non-manufacturing industry groups by using an econometric model. Within the model the industry three primary employment sectors--export, interindustry, and local serving. The model was driven by an

Figure - 2

OVERVIEW OF ABAG'S POPULATION, EMPLOYMENT, AND LAND USE MODELING SYSTEM

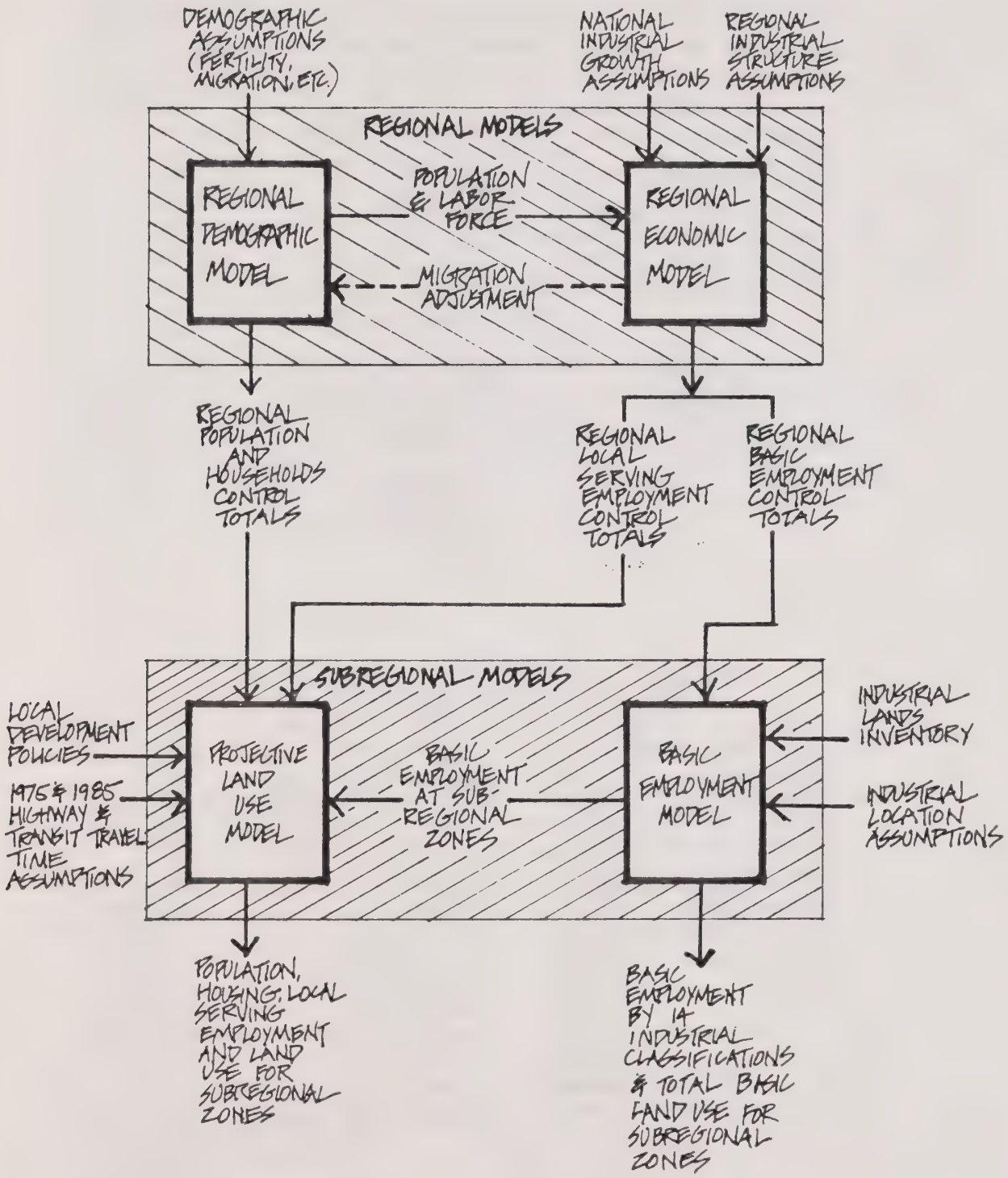


TABLE 1

SUMMARY OF SELECTED MODEL FEATURES

MODELS	BASE YEAR INPUTS	NON-POLICY INPUTS	POLICY INPUTS
REGIONAL:			
DEMOGRAPHIC	- 1975 Population and Households	Demographic Trends - Fertility - Migration - Mortality - Household Headship - Labor Force Participation	*
ECONOMIC	- 1975 Basic and Local Serving Employment	- National growth trends of basic employment - Regional industrial structure and trend assumptions	- Air quality restrictions on selected industries
SUBREGIONAL:			
BASIC EMPLOYMENT: (BEMOD)	- 1975 Basic Employment and related land uses	- Future timing and location of selected industrial development	- Developable industrial land - Service provisions
PROJECTIVE LAND USE (PLUM)	- 1975 Population, Households, Local Serving Employment and Related Land Uses	- Household size trends - Future timing of commercial and residential development - Average auto travel time trends	- Developable residential & commercial land - Service provisions - Densities - Special restrictions to development - Redevelopment - Transportation accessibility

*Demographic variables were not considered to be under direct policy control at the local level.

externally supplied projection of the national economy, regional population and labor force supplied by the demographic model, and assumptions about the regional industrial structure.

The economic model projects export (basic) and local serving employment. The basic employment, organized into 14 industrial classifications, was then supplied to the Basic Employment Model (BEMOD), for allocation to the subregional zones; the local serving employment is supplied to the Projection Land Use Model also for subregional allocation.

The manufacturing groups, i.e., the export employment sector, were projected for the region using the shift-shares method. This method involves an historical examination of the performance of an industry regionally with that same industry nationally. The national projections were generally derived from the U.S. Departments of Commerce and Agriculture OBERS Projections, Series "E" (April, 1974).

Table 2 shows the manufacturing groups and summarizes the 1970-75 analysis. For those industries where the regional growth rate exceeded the national rate, the region has a "comparative advantage." Similarly, for those which did not the region has a "comparative disadvantage." After determining in which manufacturing groups the region historically had comparative advantages and disadvantages, the next step was to make assumptions about what would happen in the future.

TABLE 2

COMPARISON OF BAY REGION AND NATIONAL GROWTH TRENDS
OF MANUFACTURING INDUSTRY GROUPS, 1970-75

INDUSTRIES GROWING FASTER THAN NATIONAL RATE, 1970-75 (Comparative Advantage)	INDUSTRIES GROWING SLOWER THAN NATIONAL RATE, 1970-75 (Comparative Disadvantage)
Industry	Industry
Ordnance	Food
Textiles	Lumber
Apparel	Furniture
Chemicals	Paper
Leather	Printing
Primary Metals	Petroleum
Non electrical Machinery	Rubber
Electric Test & Distributing Equipment	Stone, Clay and Glass
Communication Equipment	Fabricated Metals
Electronic Components	Radio & TV Receiving Equipment
Other Electrical Equipment	
Transportation Equipment	
Instruments	
Miscellaneous Manufacturing	

The economic model then used the basic employment and demographic projections to produce projections of the interindustry and local serving sectors. The equations which interrelate the various industry sectors were calibrated over the 1965-1975 period. The main source of the economic times series information was derived from the California State Economic Development Department (EDD) which maintains quarterly records of employment.

Balancing Regional Economic and Demographic Projections

Before the regional projections are allocated to subregional zones, a key step in the process is to balance labor force projections with the employment projections. Essentially, the two projections were examined outside the models to see if a reasonable level of labor force was projected in relation to the number of jobs. This usually requires several iterations of the two models and is achieved both by returning to the demographic model and adjusting migration rates and altering assumptions about the timing and mix of the export employment growth in the economic model.

Basic Employment Model

The balanced regional projections, or control totals, were then allocated to the subregional zones which are aggregations of census tracts. The subregional allocation process began with the Basic Employment Model (Nathanson, 1970). The basic employment groups were allocated to the four SMSA's (Standard Metropolitan Statistical Areas) within the region before they were supplied to BEMOD. Other inputs to BEMOD included policy information about the developability of vacant industrial land and non-policy assumptions about future timing and location of selected industrial development. These latter assumptions were based primarily on unique local knowledge and staff judgment.

BEMOD allocated the regional projections of basic employment to the zones along with related land uses within each of the four SMSA's. The allocation function combined the policy and non-policy inputs to yield the relative attractiveness of the zones for future industrial development. The basic employment by zones was also a primary input to the Projective Land Use Model. The 1975 employment data base was derived by projecting the 1970 Census place-of-work information forward and adjusting this with EDD information and local employment inventories when they were available.

Projective Land Use Model

The regional population, household and local serving employment control totals were first input to the Projective Land Use Model (PLUM). These control totals were allocated to subregional zones along with related land uses based on the distribution of basic employment supplied by BEMOD and the policy and non-policy assumptions regarding the developability of land.

PLUM is a Lowry derivative model (Wilson, 1974) in which the location of basic employment drives the location of households and local-serving employment. The allocation function of PLUM defines a set of probabilities for households locating in a zone based primarily on its transportation accessibility to basic employment and the attractiveness of zone specific housing opportunities. Local-serving employment is allocated in a similar manner based on the location of the basic households and basic employment.

The attractiveness of housing opportunities was defined primarily from a survey of local development and service provision policies. The policy variables, summarized in Table 1, include the developability of land, residential densities, and any special constraints to, or opportunities for, development.

The regional transportation accessibilities were based on future year assumptions provided by MTC (Metropolitan Transportation Commission) staff interpretation of the MTC regional transportation plan. One key assumption by MTC staff was the programs to improve the efficiency of the existing system through operational improvements, better management, and requiring limited capital expenditure were more likely to be realized than major new capital facilities.

The data base combined information from the special mid-decade censuses in the Bay Area and estimates where mid-decade censuses were not taken. The population and household estimates were supplied by the California Department of Finance for jurisdiction and counties and used as a control on 1970 census tract data projected forward to 1975.

Policy Testing with the Modeling System

Policy testing requires the assessment of problems, the identification of policies that have an influence on those problems, and measuring the effects of policy changes. The survey of local development policies defined the initial policy space. Since these were policies most directly influenced by local and regional agencies, it meant that the subregional models, BEMOD and PLUM, were the primary ones used for the policy testing.

The local policy survey inventoried land use management policies currently in force by local jurisdictions which could either encourage or constrain growth and development. They provided the starting point and were assumed to be either altered or augmented for purposes of policy testing. Regional transportation policies were also assumed to change consistent with assumed changes in land use, particularly in regard to transit ridership and to encourage a reduction in the use of the private automobile.

It should be stressed that policy instruments were tested as packages rather than individually. The policies were structured in order to focus on particular problem areas. For example, a set of "compact growth" policies were tested which would reduce auto commuting and encourage more use of transit, thereby leading to a relative improvement

in air quality. The types of policies selected for testing in this example would influence the location of jobs and housing and increase residential densities to be more transit supportive.

Extensive structuring and analysis of policy information was necessary both prior to the model applications and after the model outputs were available. This analysis and judgment outside the modeling system required certain changes in the subregional models to make them responsive to the policy information used as input and to make the output useful for policy analysis. This moved the models substantially from their theoretical structure to be more sensitive to the policy analysis. For example, major sections of PLUM were removed in order to directly incorporate local policy information regarding the density and timing of development. The basic employment model (BEMOD) was modified to more easily incorporate local information and judgment regarding future industrial development.

THE STRUCTURE FOR LOCAL PARTICIPATION

A key ingredient in developing the projections was active local participation in all stages of the work; from conceptual approach through application of the projections. Earlier ABAG experience had demonstrated the importance of this.

Lack of Local Participation in Earlier Regional Projections

Earlier attempts by ABAG to develop regionwide small-area projections had lacked significant local participation. In 1972-73 two successive series of projections were developed for use in regional programs by ABAG and State agencies. Local participation came after-the-fact with local review of the results--too much information had to be dealt with, too late in the process.

Local jurisdictions had no role in determining the basic premises of the earlier projections. The land use policy base for the projections had been the ABAG Regional Plan land use element. There had been no systematic input of current local information in the earlier projections. Thus, major local government decisions were unrecognized. These unrecognized decisions included widespread local growth moratoria, a regionwide trend to "downzoning" and some jurisdictions' commitments to large land developments.

This problem was further compounded in the application of the earlier projections in regional studies. Regional and State agencies used the earlier small area projections (for areas typically 10 to 15 square miles in size) with little or no understanding of their limitations--usually without consulting either ABAG or the appropriate local jurisdiction. In some cases the earlier small area projections became key parts of formulas to allocate State and Federal grant funds.

This experience made both ABAG and the region's cities and counties extremely sensitive about both the development and the use of regional projections. ABAG subsequently adopted guidelines for the use of the earlier projections, and these guidelines recognized their shortcomings.

A New Structure and Process for Local Participation

A new structure was developed to maximize local participation at each of five stages:

- Conceptual approach
- Data collection
- Data translation into the models
- Review and revision
- Application of the Series 3 Projections

A variety of participatory devices were used.

A Projections Technical Advisory Committee (PTAC) was formed to advise in the conceptual approach, monitor data collection and translation, organize and conduct local review, and monitor the application of the projections. The advisory committee was composed primarily of local planning agencies with representation from special districts and regional and state agencies as appropriate subjects were studied.

Beginning in early 1975, PTAC had about one year to learn about the workings of the modeling system and consider the conceptual approach being developed by ABAG. Discussion papers were reviewed and workshops held. Outside specialists participated in these workshops but the final design of the conceptual approach fell to the committee and ABAG staff.

The need for specific information about local development policies and policy instruments required more formally structured local participation. As part of the "208" funded regional environmental program*, contracts were entered into with a "lead agency" in each county to collect the necessary data and assist ABAG in structuring its input to the modeling system. The contracting agency in most cases was the county planning department.

A survey was designed for the purpose of collecting information on local land development and urban service policies. The survey in each county was conducted by the contracting county agency, with ABAG assistance. The county agency interviewed city, county or special district agencies having a role in land development, transportation, sewer or water service in that county. A total of 126 local agencies, including 17 significant special districts, were interviewed over a four month period.

Structuring the data about local development policy into the projection modeling system was a crucial stage for local participation. It was essential that the lead agency in each county understand how the information on local development policy was being used and its effect on the resulting projections. A working understanding of this translation stage by the contracting county agency was essential to their leading role in later review by their local agencies. The contract called for the county agency to work with ABAG to structure the local area data for input to the projection modeling system.

After the first set of preliminary projections were developed, a review program was carried out in each county. The format included workshops in each county with follow-up meetings, letters and phone calls to iron out special problems. The first round of workshops covered the review of the policy information obtained in the interviews, how it was input to the projection modeling system, and the resulting preliminary small-area projections. The workshops were staffed jointly by ABAG and the county lead agencies.

---

*"208" refers to areawide waste treatment planning as provided for under Section 208 of the Federal Water Pollution Control Act of 1972, as amended.

The initial review program resulted in the publication of a provisional set of projections in March, 1977, about one year after the conceptual stage had been finished. The provisional projections were the first projections emanating from this effort that were then used in regional programs. The provisional projections were released for wider review by both participating and non-participating agencies and the general public.

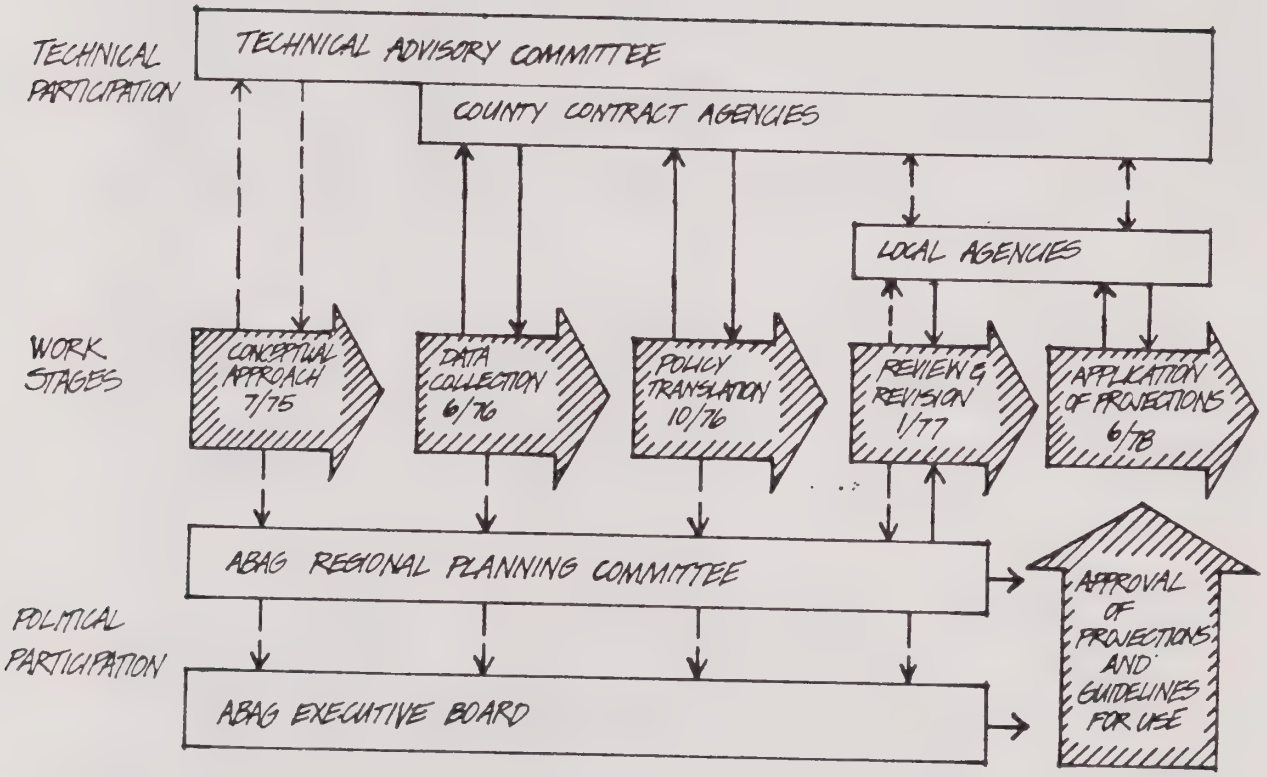
Local participation in the application of the projections to a variety of regional agency programs has evolved over the last year of experience--primarily in ABAG's regionwide Environmental Management Plan program (EMP) and in subregional transportation studies. The county lead agencies, functioning both on their own and as members of the Projections Technical Advisory Committee, monitored the use of the projections in the regionwide EMP. Local agency staff worked directly with regional agencies in the application of the projections in the transportation studies. This continuing review role resulted in new local information being built into the projections for a full year after their first publication and application.

Local participation in the application of the projections in regional and state agency programs continues as required by state policy. California's urban strategy (An Urban Strategy for California, February 1978) mandates the use of approved regional projections by all state agencies. The California Governor's Office of Planning and Research (OPR) monitors the development of the projections to assure they meet state requirements--including local participation. OPR also oversees their use by the other state agencies.

Local participation means participation by local policy-makers as well as by local technicians. ABAG's Regional Planning Committee, composed of elected and appointed local officials and special interest representatives, and the ABAG Executive Board, composed of local elected officeholders, were informed at each work stage of the progress and problems. The Regional Planning Committee, after local review, approved the use of the projections in ABAG programs. Both the Regional Planning Committee and the Executive Board considered and approved a set of Guidelines for the use of the projections. The intent of local participation in this continuing stage of the regional projection process is to assure that any new information affecting growth and development in that local area is considered when the projections are applied. Such new information might include unique information not considered at the time the projections were developed, or updated information on factors that were considered but where conditions--perhaps policies--have changed.

Figure - 3

OVERVIEW OF LOCAL PARTICIPATION



KEY:

—→ REPORT / ADVICE

⟶ ACTION

THE DEVELOPMENT OF REGIONAL PROJECTIONS: BALANCING POLICY CONCERNS AND TECHNICAL FACTORS

Developing projections from a regional versus a local perspective can lead to quite different conclusions about future growth. When a number of communities develop plans independently, the growth restrictions and growth inducements are often not coordinated. One of the striking findings of the Series 3 projections, for example, was that many communities had great expectations for employment growth, without corresponding growth in housing. While the policy-defined developable land for residential uses could not accommodate the projected regional housing demand much beyond 1990, less than 25 percent of the industrial vacant land was projected to be absorbed by the year 2000. The desire for greater industrial development may have been motivated by fiscal considerations, but it implied a much larger population and labor force than was consistent with either the local capacity for housing or the regional employment projections.

Balancing local policy concerns, which in many cases reflected both expectations and desires, with each other and with regional projections based largely on technical factors, led to an iterative process of trial runs and local reviews. The policy and technical issues were discussed over a two year period with a technical advisory committee and through review of the assumptions by cities and special districts throughout the region. Adjustments were made primarily in the representation of local development policies in order to accommodate the level and distribution of projected growth, although some technical adjustements were also made. The adjustments to achieve consistent regionwide projections recognized that market and policy forces interact in a complex manner and are not adequately treated by the subregional models.

The development of regional projections involved two stages:

1) projection of a plausible range of regional growth; and
2) allocation of the regional range to subregional areas.

As mentioned earlier, the key concepts underlying the regional range were that the assumptions were consistent and that the projections defined a plausible range of growth. The subregional projections resulted from the interplay between the regional projections and the aggregate of local policy instruments premised on managing that growth.

For this discussion, technical factors refer to uncontrolled events or policy actions not directly within the realm of local and regional agencies. Policy concerns refers to the policy instruments--whether legal, financial or administrative--that can be implemented by local and regional agencies.

A major policy concern of local governments was that their policies be "accurately" represented, so as to result in their own end-state projection. It was viewed by many local governments that regional

projections should exactly equal local projections*--implying that the regional total should match the aggregate of local projections. A major policy concern from the regional perspective was that a plausible and consistent set of regionwide projections be developed that accounted for policy instruments currently in force. These projections would then be used as a starting point for problem identification and analysis of inter-jurisdictional policy conflict. A regional end-state plan was not being represented as had been done in earlier series of projections by ABAG. Rather, needed changes in regional and/or local policies would emerge in specific areas from the policy analytic process.

Balancing policy concerns with technical factors is not a process that necessarily leads to a "correct" result. Structuring a set of policy adjustments to accommodate a range of future regional growth was a process that involved a large number of policy assumptions and regular interaction with a technical advisory committee and local planners. The process resulted in a consistent set of projections and, further, focused on a number of fundamental policy issues.

The Development of a Regional Growth Range

The regional range was projected using the regional demographic and economic models described earlier. Because of uncertainties inherent in projections, the range was designed to bracket possible futures and was based on plausible assumptions about regional growth. This led to the structuring of two different, but internally consistent, sets of assumptions for a higher and a lower regional projection. It was primarily a technical exercise of examining National and State trends, selecting plausible demographic and economic assumptions, and then operating the models through several iterations until a consistent set of demographic and economic projections was achieved.

Structuring assumptions that were internally consistent simply meant that obvious relationships were observed. For example, lower fertility rates implied higher female participation in the labor force and declining household sizes. Also, migration levels were adjusted so that labor force projections were consistent with employment projections.

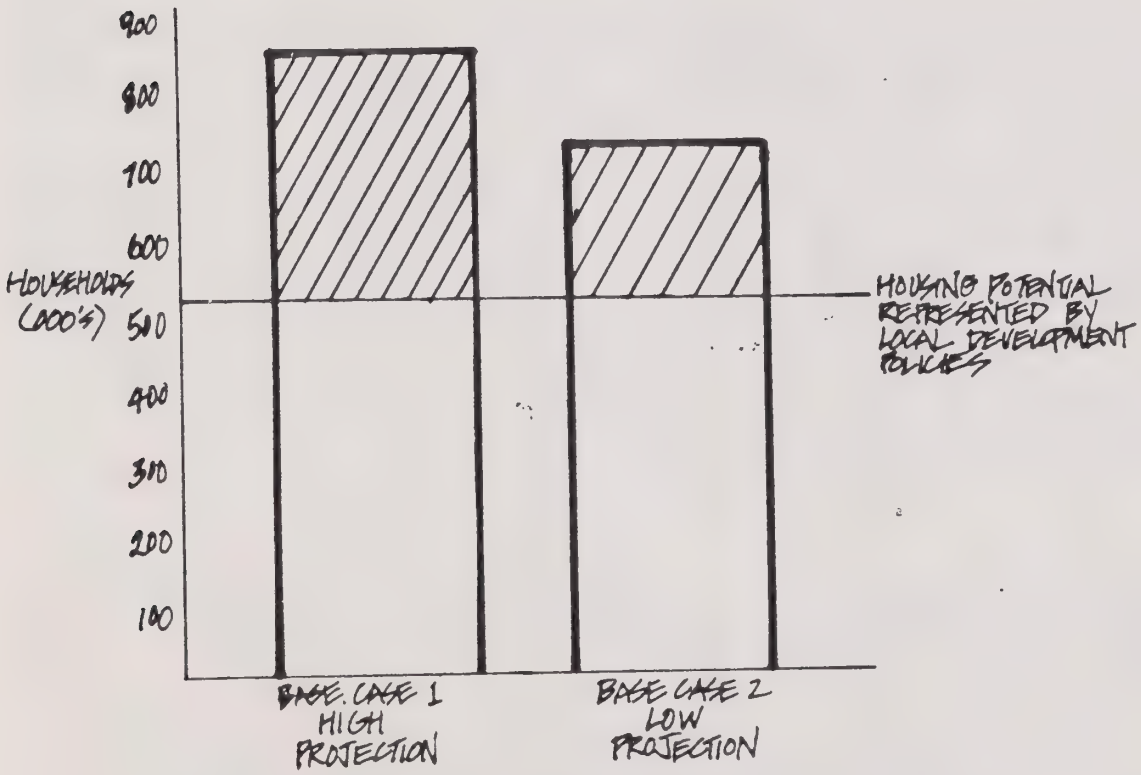
The major demographic variables that required technical specification were fertility, mortality, migration, household headship, and labor force participation. Fertility rates historically have been declining in the Bay Region and a range of completed fertility of 1.5 to 1.8 children per woman was considered plausible. This implied more women in the labor force, smaller households, and in-migration as a significant source of regional growth.

---

*Some local planners recognized the technical validity of regional projections identifying policy conflict but still feared the possibility of some users of projections taking them to be policy and thus having projections become "self-fulfilling prophesies" of unwanted futures.

Figure - 4

PROJECTED INCREMENTAL GROWTH IN HOUSEHOLDS COMPARED WITH HOUSING POTENTIAL REPRESENTED BY LOCAL DEVELOPMENT POLICIES



The major economic variables were the assumptions about national industrial growth and trends in the region's industrial structure. OBERS Projections, Series "E" (April 1974) were assumed as the National projections. Future regional growth rates for manufacturing industries were based on these projections, as well as estimates of past regional rates vis-a-vis the nation. Regional growth rates exceeding those for the nation were assumed to converge with the national rates as they are carried forward into the future, i.e., the region's comparative advantage was assumed to gradually diminish. The major difference between the regional economic assumptions in the two base case projections was that this convergence of the regional and national growth rates was assumed to happen sooner under the lower projections.

A balance between labor force and employment was achieved in the regional projections by adjusting the assumptions regarding migration and the rate of change in key industrial sectors. This involved several iterations of the models and resulted in an increasing rate of annual change in inmigration for the higher economic projection, and a decreasing rate of annual change for the lower economic projection. Under both projections inmigration was an important source of additional labor force.

The regional projections of population for the Bay Area resulted in a range of 5.4 to 6.1 million persons for the year 2000, compared to a 1975 population of 4.8 million. Labor force (and employment) were estimated to grow at a faster rate than total population, primarily due to increasing labor force participation among women. Households were estimated to grow at a faster annual rate than either population or labor force due to the rapid decrease in household sizes with declining fertility, increasing divorce rates and lower mortality.

The Initial Allocation to Subregional Areas

The next step in the process was to allocate the regional range to 440 subregional zones. The local land development policies were the primary assumptions influencing the distribution of growth, although regional highway and transit assumptions were also signfiicant. The two subregional models, BEMOD and PLUM, were used to perform the allocation.

The local policy instruments were quantified to represent the capacity for different types of land uses, primarily residential, commercial and industrial. The policy instruments represented were the specific actions currently in force by local agencies. Initially, it was expected that the aggregate of local policies would accommodate the regional growth. However, the projected growth in households could not be accommodated beyond 1990 under either regional projection. As shown in Figure 4, approximately 40 to 60 percent more housing units would be needed by the year 2000 than was represented by the local policy specified housing capability. The primary factors were the decreasing residential densities represented in the local policies and inadequate information regarding the potential for redevelopment and infill housing.

Additionally, several distributional issues emerged after the initial allocation. First, it was found that the projected basic employment

consumed less than 25 percent of the vacant industrial land; and second, the local perception of declining household size trends was generally less than expressed in the regional projections. Thus, adjustments to the initial allocation were required.

Adjustments to the Subregional Allocation

The local policy instruments were assumed to change to accommodate the projected regional growth to the year 2000. The rationale was that the regional projections were already conservative compared to recent historical trends, and that only concerted, coordinated regionwide growth management programs would further constrain this trend. In effect, the assumption was that local jurisdictions, acting independently, would not effectively constrain total regional growth below the lower regional projection.

What would actually happen in the real world would be a complex interaction of policy and market forces. For modeling purposes, the assumption was made that many of the local policies represented only a short-term housing potential constrained by limited urban service commitments, not a long-term holding capacity. Under this assumption, the representation of local policies was adjusted to reflect possible changes in the long-term, or after 1985. An increase in potential housing supply was assumed primarily through two adjustments: 1) increasing residential densities at the suburban fringe; and 2) increasing the infill and redevelopment of housing in central, urbanized areas. Small adjustments were also made in the household headship rates to reflect the assumption that not all of the needed housing would be provided through construction, and that some doubling and delayed household formations would occur. This implied changes in living arrangements such as more single individuals sharing living quarters and children remaining at home longer.

The policy instruments affecting land development that were in force in 1975 are summarized in Table 3. The policy survey information can be used to identify such "bundles of policy instruments" in effect in each locality, and their general aggregate effect on development potential. With this information assumed policy adjustments in model testing can be related to specific policy instruments of specific jurisdictions. Generally, the test policy adjustments were made on a regionwide basis. For example, assumed residential density increases were primarily confined to what was designated prime lands--that is, vacant land that was zoned for development, with urban services either already provided or committed, and no overriding environmental constraints. In addition, the assumed policy changes were kept modest in order not to be inconsistent with the existing neighborhood character.

Generally, the policy survey provided a wealth of information regarding tracts of developable land in peripheral areas. However, information was inadequate for infill development, i.e., scattered, vacant parcels within urbanized areas, and the potential for private redevelopment. Although a few communities had detailed parcel inventories, the potential for this type of development had to be estimated, relying on limited information and local judgment.

TABLE 3

SUMMARY OF
LAND DEVELOPMENT POLICY INSTRUMENTS IN EFFECT
BAY AREA 1975

Land Development Policy Instruments (In rank order by frequency regionwide within group)	Number of Jurisdictions Using Policy Instruments
Group 1 Supporting Development	
Assessment (improvement) Districts	34
Public Assisted Housing Programs	25
Redevelopment Programs	15
Transportation Extension C.I.P.	21
Sewer Extension Capital Improvement Program	14
Public Housing Programs	9
Water Extension Capital Improvement Program	8
Low Income Housing Program	8
Special Service Commitments	6
Sale of Public Land	6
Industrial/Commercial Land Reserve (other than zoning)	0
Group 2 Neutral or Mixed (Used to support or constrain Development)	
City Spheres of Influence (by LAFCO)	39
Development Fees	37
User Charges	32
Cluster Zoning	28
Slope/Density Zoning	21
Plan Conformance Re-zoning	19
Mass "UP" or "Down" Zoning	11
Development Rights-Purchase or Transfer	8
Land Banking	3
Development Sequence Zoning	4
"Floating Zones"	3
Group 3 Constraining Development	
Open Space Zoning	26
Open Space Easements	23
Zoning Moratorium	18
Sewer Connection Limits	20
Land Acquisition for Public Use	20
Prime Agricultural Land Preserves	11
Building Permit Moratorium	11
Watershed Protection Program	13
Transportation Access Limits	12
Water Connection Limits	7
Other Utility Connection Moratorium	7

Source: ABAG Local Development Policy Survey, 8/15/7[illegible]. 65 cities reported of 76 which ultimately responded. [illegible]pecial districts not included.

The above adjustments focused on augmenting the represented local capacity for development. Additional adjustments were made that affected the distribution of population and employment. A technical adjustment was made to the equation that estimated subregional household sizes. It was recalibrated to relate household sizes to specific local information about housing type and density. This better reflected unique characteristics about the movement of families from urban to suburban areas.

Another difficult subregional issue dealt with the location of basic employment, which is a land use activity that strongly influences the location of other activities, particularly residential land uses. This problem was exemplified regionwide by the fact that the regional projection of basic industrial growth would require less than 25% of the land set aside by local jurisdictions as industrial reserves. It became clear that a disproportionate amount of regional industrial growth would be needed to match the sum of local jurisdictions' expectations of employment growth. In the subregional allocations this disparity was handled through detailed review with local planning officials focusing on committed or highly probable new industrial developments, as well as examination of subregional trends.

The development of regional projections combining a regional and a local perspective involved a series of feedback adjustments. Through this process everyone became more aware of the major policy and technical issues. Additionally, the models were made more responsive to local policy information. The process resulted in a set of usable projections that had general support although not total consensus. The projections were released initially as provisional projections so that later review and revisions would be mandatory. This was in keeping with the conceptual approach that viewed projections as indicators of future conditions and not end-state targets.

APPLICATION OF PROJECTIONS TO REGIONAL PLANNING

To date, the Series 3 Projections have been applied to a variety of regional and subregional planning programs. The key has been their use as general guides for problem analysis and policy formulation--not as specific forecasts of a desired end-state plan. In the regional Environmental Management Plan, they were an important technical base for the Air Quality Maintenance Plan as well as the Water Quality Plan's 20-year sewage treatment plant project list. As applied by ABAG to its other programs, the projections have constituted a technical framework for maintaining consistency among plan elements. Independent application of the projections by other regional and state agencies has necessitated the issuance of ABAG's Guidelines for the Use of Regional Projections.

Policy Testing in the Air Quality Maintenance Plan

In the Air Quality Maintenance Plan (AQMP) for the Bay Area, the Series 3 regional projections were used to forecast future air quality conditions under a variety of assumptions. The first forecast was an estimate of the future air quality problems assuming the continuation of local agencies' current land development policies and also assuming existing air pollution control programs. Both high and low base cases were examined in this regard. The high base case was recognized as a "baseline" forecast consistent with other regional programs, including the regional housing plan's estimate of regional housing need. In a subsequent estimate the low base case was examined as a "slow growth" scenario to determine the effects of growth, alone, on air pollution. It was estimated that with the lower population growth hydrocarbon emissions would be reduced about 5½% from the year 2000 high case (baseline) forecast.

The projection system was also used to estimate the effectiveness of alternative control strategies in improving future air quality. A broad spectrum of technological control measures together with regionwide transportation controls and land use management were tested.* Details of the control strategy testing in the Bay Region AQMP are described in another conference paper (Hoffman/Leong/Wada, 1978). However, the ABAG experience in estimating the potential effect on air quality of a regionwide land use alternative is worth focusing on here. Whereas the low base case had been tested to determine the effects of population growth on air quality, the land use alternative was tested to determine the effects of a different land development pattern, assuming either the high or low population projection.

---

*Technical controls tested included regulation of paints and other surface coatings, closed systems for storage and transfer of organic liquids, best available control technology (BACT) on existing and new sources of hydrocarbon emissions, more stringent vehicle exhaust emission standards, and a mandatory annual inspection and maintenance program for light and heavy duty vehicles.

The test of the land use alternative serves as an example of using the projection system in the policy analytic feed-back framework described in the conceptual section. The feed-back procedure was to specify potential policy changes, develop new projections based on those policies, and assess their effects. The assessment focused not only on the effect of the policy changes on air quality but also their impacts on other areas of interest: environmental, financial/institutional, social and economic.

This land use test alternative, termed the "Compact Growth" alternative, was premised on a regionwide set of policy actions that could be carried out by local agencies to achieve a more compact land development pattern assuming either the high growth or low growth projections. This growth pattern would be expected to achieve two air quality objectives: reduce long distance auto commuting; and reduce auto trips while increasing transit use.

To achieve this reduced auto dependency the Compact Growth alternative would seek to reverse three fundamental characteristics of Bay Area development of the last 20 to 30 years:

- Shift the location of growth emphasis from outlying suburbs back to established cities--mostly to the smaller and less built-up cities;
- Bring housing and jobs throughout the region back into closer proximity and toward a balanced mixture of housing and jobs in most subregional "labor sheds;"
- Increase permitted densities of new development from the current trend of lower densities toward more transit supportive higher densities.

The Compact Growth Alternative was structured around the identification of specific policies and actions that specific local jurisdictions could implement to achieve a measurably more compact pattern of urban development across the region. The previously described regionwide survey of cities, counties and special districts' development policy indicated that some agencies were already implementing such policies as higher densities in planned unit developments, staging development consistent with urban service commitments of the existing cities, encouraging development near rail transit, etc. However, such actions were scattered and not based on air quality analysis. The hypothesis to be tested with the air quality plan land use alternative was that consistent application of such policies by local jurisdictions regionwide could yield a significant air quality improvement.

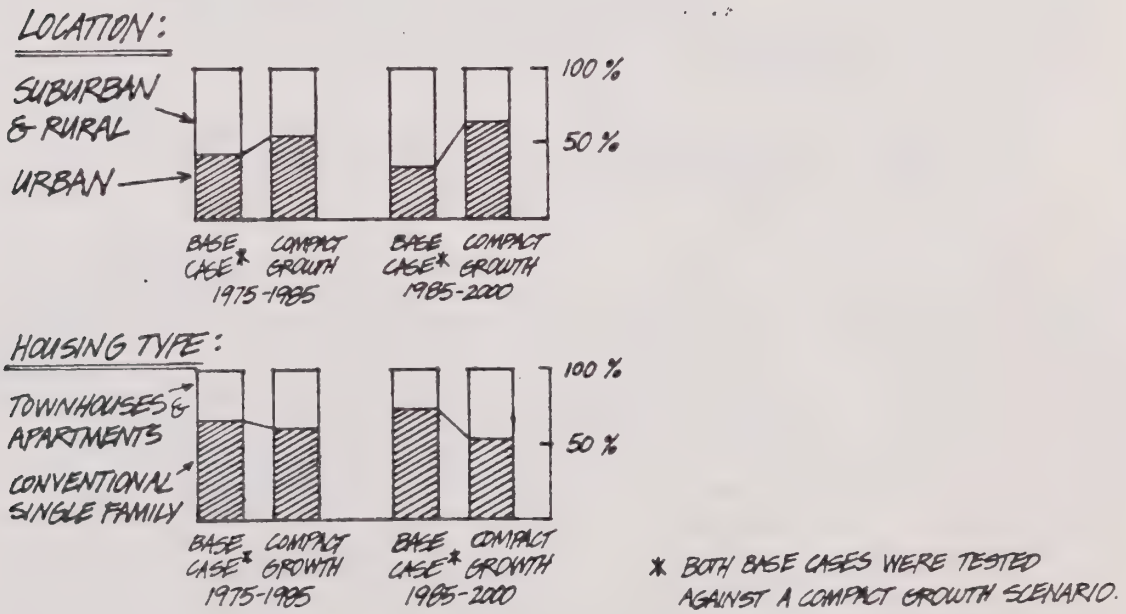
The projection system was used in the Compact Growth Alternative to quantify feasible shifts in policy during the 25-year projection period. Technical advisory committee review indicated that a change in policy restricting extremely low density development beyond the reach of urban services would be a reasonable assumption by 1980, but that encouraging high density development within the already developing area could not be reasonably assumed within ten years. It was assumed that the same

regional total growth in population and households would occur as in the base cases, but that they would be accommodated in a more compact distribution: less development in auto dependent low density suburban and rural locations; more development closer to existing job centers and rail transit.

The resulting projected difference in location and density of new housing is indicated in Figure 5. In the short term future the projection indicated a moderate shift of about 10% from suburban to urban locations and about 5% from conventional single family units to townhouses and apartments. In the longer term future the projected shift would be more pronounced with a 23% shift to urban locations and an 18% shift to the higher density housing types.

Figure - 5

EFFECT OF COMPACT GROWTH ON THE PROJECTED DISTRIBUTION OF NEW HOUSING



This difference in projected land development patterns over the full 25 year period, when paired with appropriate assumptions of improved transit service, was estimated to yield a total reduction of 11% in vehicle miles traveled. This would translate into about 5% of the total reduction in emissions needed to meet federal air quality standards.

The question of low growth and land use management to achieve air quality objectives aroused considerably more policy debate than the more technological controls tested in the Air Quality Management Plan comprehensive strategy. As a result of the projection analyses the potential air quality benefits were clearly measurable. However, the potential impacts in other areas of concern, notably institutional and social/economic, were less clear. The assessment analysis raised many questions without easy answers about such concerns as the housing market and the social equity issues of who would bear the greatest burden. Such questions loomed exceedingly large in the air quality political debate. The institutional impact, which could not be technically measured or assessed, was the potential for Federal, State or regional interference in local land use decisions. It was this question without any clear answer that influenced heated debate of the AQMP in city councils and county boards of supervisors throughout the Bay Area.

Debate at the policy levels of ABAG, including the ad hoc advisory Environmental Management Task Force and the ABAG Executive Board and General Assembly, resulted in deletion of the proposed land use management strategy from the final Air Quality Maintenance Plan. This debate was influenced by the technical analyses which did indicate that the land use controls would not be as effective as other control measures. Other controls such as more stringent restrictions on vehicle emissions, small gasoline engines, and off-highway vehicles would have to fill the void, along with transit service improvements beyond those currently planned.

Water Quality Planning - The 20-Year Project List

In the Water Quality Plan for the Bay Area the Series 3 projections were used to evaluate a regionwide 20-year project list of municipal wastewater facilities. Amendments to the Federal Water Pollution Control Act (FWPCA) of 1972 required that such a project list be part of the plan developed under Section 208, and that Federal EPA grants for construction of publicly owned treatment facilities, under Section 201, must be in conformance with the 208 plan project list.

The wastewater facilities project list is the water quality element most directly related to population growth and land development. It is also the key water quality plan element which must be consistent with the air quality plan, especially as regards growth inducement.

The project list included over 200 subregional projects in nine counties for which funds being sought total just over $2 billion. Most of the projects already are in various stages of planning and construction by counties, cities, special districts or joint powers agencies, and state agencies. Almost half were treatment plants, about one-quarter collection or transport systems, and the remainder were wastewater reclamation facilities.

The breakdown of projects and costs for various stages was as follows:

Stage	Number of Projects*	Total Cost
Facilities Planning	126	$9.8 million
Plans and Specifications	160	$116.9 million
Construction	191	$2,029.0 million
		$2,155.7 million

*Funding for most projects is being sought for 2 or 3 stages

The role of the projections in the evaluation was not as detailed indicators of the needed size of the wastewater facilities. This would occur when the detailed planning stage begins. Rather, their role was to serve as general indicators of where and when the facilities would be needed, assuming either high or low regional growth rates; and assuming patterns and timing of development most likely to result from current local policy on land development and urban services. The high base case population projections for service area of each facility were converted to capacity measures (million gallons per day) and used to estimate the year that general capacity levels and funding would be needed. The higher regional growth projection had been selected by ABAG regional policy makers as the upper growth assumption for which regional facilities and programs should be planned. Politically, the high projection was preferred because it would allow more flexibility for later planning stages such as the setting of sewage treatment plant capacities. Technically, it was judged to be more consistent with the single baseline projection of the California State Department of Finance, which would facilitate coordination with statewide planning programs.

In addition to the identification of location and timing priorities consistent with the high projection, further analysis indicated those projects where either low population growth or potential changes in land development policy could significantly change the timing and general capacity needs for wastewater facilities. Both the lower projection base case and the air quality plan's compact land development alternative were examined in this regard.

This analysis indicated that if the lower regional growth rate does occur, seven projects estimated to cost just under $74 million would not be needed. Thus, some funding options could be kept open pending further information on non-policy factors such as fertility and migration. The lower growth rate would appear to affect only about 3% of the estimated $2.1 billion wastewater funding. The remaining projects would not be affected by the lower regional growth rate.

The regionwide Compact Growth land use alternative was also examined to see which funding options should be kept open if an alternative of this type were implemented. Fourteen relatively small projects, all located in the developing suburban areas, and amounting to $55 million (2½% of the total funding), would be affected by such a change in the regionwide development pattern. Eleven projects located at the suburban fringe and amounting to $45 million could be delayed up to five years. Three projects located in the metropolitan core and totaling $10 million would need to be accelerated toward completion to assist in implementing such a compact growth scenario.

Consistency Among Plan Elements

The Series 3 Projections provide a consistent data base and set of growth projections for use in all Bay Area regional planning programs. As a result, the work in each planning program proceeds on the basis of consistent technical assumptions about regionwide population growth as well as consistent policy assumptions about land development. Each planning program then identifies the special problems inherent in the projections relative to the objectives of that program, and proposes policy solutions which can then be assessed for their potential impact on current policies represented in the projections. Inconsistencies in proposed policies in different plan elements can also be traced through their representation in the base case projections.

With the projections as a common quantitative framework, specifics about growth and development can be related to potential future problems in a variety of policy areas.

ABAG's Guidelines for the Use of the Projections

As previously indicated in the discussion of local participation, the need for specific guidelines for the use of the projections resulted from both ABAG's own experience in application of the projections in the Environmental Management Plan and previous experience with the use of earlier ABAG projections by other agencies.

The underlying objectives of such guidelines are to forestall the assumption by users that the projections, in and of themselves, are policy; and to make it clear to users that the projections should not be applied without consultation with ABAG and appropriate local agencies.

The guidelines as issued by ABAG note four specific purposes:

- to describe the general assumptions which underlie the projections;
- to indicate limitations for their use;
- to describe the use of the projections in regional planning programs;

- to explain the procedure for incorporating and disseminating new information which affects the projections.

The general assumptions described in the guidelines include the national and regional socio/economic trends; the regional transportaiton system; and the local land development and service provision policies, all as described earlier in this paper.

The limitations include specific statements that the projections are not in themselves policy targets or goals and that they are intended to provide information concerning a range of future conditions. The guidelines indicate the limitations of applying projections both at small geographic scale and at remote points in time. It is also noted that the projections will be updated as significant changes in trends or policies occur.

The description of the use of the projections in regional planning programs is intended to encourage their use by organizations wanting to coordinate their planning programs with specific regional programs.

ABAG's experience to date indicates that a most important section of the guidelines deals with incorporating new information. New information includes updated trends on the technical, economic and demographic factors affecting total regional growth as well as supplemental information on local conditions which may affect the policy base of the projections. ABAG's experience indicates that both technical trends and policy can change dramatically in a few years.

The guidelines urge all users wishing to make subregional applicaiton of the projections, especially in finer disaggregaitons to small geographic areas, to consult both with ABAG and the appropriate local agencies. The guidelines commit ABAG to disseminate new information to established users of the projections as well as give needed technical assistance to all users.

The recommendation that users consult with ABAG is made more critical by the potential use of the projections by state agencies for purposes of funding allocations. Administrative policy of the State, as carried out by the California Governor's Office of Planning and Research (OPR), designates projections approved by regional councils of governments for use by all state agencies. Previously state agencies had used a mixed bag of state, regional and local projections, often with inconsistent methods of preparation and application. ABAG's policy level approval of the use of the Series 3 projections in such state programs provides for consultation with both ABAG and appropriate local agencies to ensure that the state agencies have the latest information and that their applications are consistent with ongoing regional planning programs.

SUMMARY AND CONCLUSIONS

The development of regional projections combining a regional and local perspective involved a series of openly arrived-at adjustments to policy and technical assumptions. Through this process the major policy and technical issues were brought out into the policy arena. Additionally, the urban development models were made more responsive to policy information. The process resulted in a set of usable projections that had general support although not total consensus.

The conceptual analytic framework which guided the development and application of projections stayed largely intact. A primary objective was to link technical analysis with the political process. The policy analytic framework served to focus the modeling system and analysis on issues relevant to decision-making. However, when information was introduced at the political decision-making level, reactions frequently were aimed at the political overtones rather than the substance of the analysis. This probably indicates that the actual policy feedback regarding land use management policies came too late in the process, and should have occurred at the stage when the formulation of policy alternatives was underway.

A structure for local technical participation did include substantive participation in all steps of the work. This included a technical advisory committee, contractual arrangements with the counties to supply policy information, and provision for direct participation by individual local agencies in the continuing application of the projections. As a result local technicians became more aware of the specific uses and limitations of the projections. However, the technical advisory committee as a whole tended to view issues from their jurisdictional perspective rather than in terms of regionwide problems.

Key to the ABAG use of the policy analytic approach was the starting concept of planning as a process, with the projections viewed as indicators of emerging conditions rather than as an end-state plan projection.However, it proved very difficult to carry this concept through the continuing review by individual local agencies. Although some local planners recognized the technical validity of using regional projections as indicators of potential problems and a starting point for regional policy testing, they still feared the possibility of some users of the projections taking them to be policy; thus, having the projections become "self-fulfilling prophesies" of unwanted futures.

ABAG's role in such regional policy analysis is made more imperative by events at the state and regional levels which have occurred since the concepts of ABAG's projections were set. First, the California Governor's Office of Planning and Research is responsible for the state's Urban Strategy, and this state program mandates the use of regional councils of governments' projections by state agencies' planning programs that

affect local jurisdictions--particularly state funding of wastewater treatment projects. Secondly, ABAG continues as the responsible agency designated for regional environmental planning. The potential issue of consistency between local policies and the State's Urban Strategy will need continuing policy analysis similar to that already underway in ABAG's Environmental Management Planning Program. Additionally, the technical advisory committee should be expanded to include more active participation by state agencies.

The fact that the current projections are not fixed policy targets or goals also needs to be reemphasized because of dramatic changes that can occur in both trends and policies. The fact that the current projections are not, in themselves, policy does not imply that they cannot be used in current public investment decisions. However, such use cannot be done independently. The projections must be applied in conjunction with ABAG to assure consistency with ongoing regional programs and ever-changing local conditions.

The concept of a plausible range of future growth, rather than a single line projection is also important to the question of the use of the projections in current public investment decisions. Decisions regarding public investment for long-range projects should be subjected to analysis of the potential fiscal and economic losses in selecting a single projection, high or low, which turns out to be significantly wrong--whether by virtue of changes in policy or technical trends. Given the significant changes occurring in local government financing the costs of over-or under-utilization of financial resources may loom very large. It should be noted that the concept of the use of a range to reflect the uncertainty in the assumptions was not well received. Individual agencies tended to prefer one or the other side of the range depending on their policy position or because it was easier to deal with only one projection.

Regarding the development of the current projection series for use in policy analysis, the first objective was to project a plausible range of regional growth and allocate it to subregional areas recognizing current local land development policy instruments. This was viewed as the starting point for assessment and policy testing. However, this identified significant inconsistencies such as the finding that the housing capacity represented by the aggregate of local policies could not accommodate the projected regional growth much beyond 1990. Additionally, a number of distributional issues were raised primarily relating to industrial land reserves and the location of new jobs.

More work is needed to clarify inter-jurisdictional policy conflicts and bring them into the regional political arena. These findings led to a process of balancing technical factors with local policy concerns. Balancing local policy concerns, which in many cases reflected both expectations and desires, with each other and with regional projections based largely on technical factors, led to an iterative process of local reviews and trial runs. This process was greatly aided by the advisory committee. Adjustments were made primarily in the representation of local development policies in order to accommodate the level and distribution of projected growth, although some technical adjustments were also made.

Significant policy analysis was conducted consistent with the policy analytic approach. Thoroughly based local technical participation enabled this effort to collect current and pertinent policy information from over 100 local jurisdictions and translate it into the modeling framework. Although the land use management policy alternative for the Air Quality Management Plan was politically rejected the problems it dealt with are continuing to be addressed.

One important technical benefit of the regional projections was that they provided a consistent data base and set of indicators about future regional growth and development. As a result, the work in a variety of regional planning programs proceeded on the basis of consistent technical assumptions about regionwide economic and population growth, as well as technically consistent assumptions about land development policy.

The problems described above led to ABAG policy groups adopting Guidelines for the Use of Series 3 Projections providing for continuing consultation and guidance by ABAG to all users of the projections. The guidelines also ensure that ABAG's Regional Planning Committee will have continuing oversight of the development and application of the projections which will facilitate consistency across all regional planning efforts as well as assure continuing political participation.

The guidelines explain the assumptions underlying the projections and limitations affecting their use. Additionally, a procedure for incorporating and disseminating new information is described. The guidelines also stress that the projections are not fixed policy targets or goals.

And lastly, conclusions about the use of models in this process should at least be mentioned. The modeling system performed well for providing technically usable projections of population, housing, employment and land use. The system was essential to provide a comprehensive structure around which policy and technical assumptions could be formulated and tested. It was also useful in the systematic accounting of a large number of variables and causal relationships. The models were made considerably more policy sensitive in response to the survey of local land development policies.

However, a number of significant issues had to be dealt with outside the modeling system, including development trends and policies in urbanized central city areas, residential density increases, likely changes in local policies, industrial location decisions, and the socioeconomic impact of different urbanization patterns on the people of the region. In some cases the modeling system could be modified to accommodate the specific policy objectives; in other cases, analysis had to be performed outside the modeling system. Sometimes appropriate techniques were either not available or not feasible within the time constraints.

In conjunction with its technical advisory committee, ABAG is continuing to pursue the research and development of new and improved analytical techniques.

REFERENCES

1. California Governor's Office of Planning and Research, An Urban Strategy for California, Sacramento, California, February 1978, p. 18.

2. Goldman, R.E., "The Role of Urban Development Models in Planning", Presented at the Conference on the Use of Models by Planning Agencies, Philadelphia, Pennsylvania, October 1975.

3. Hoffman, S.R., E.Y. Leong, and R.Y. Wada, "Air Quality Plan Development in the San Francisco Bay Region: Integrating Complex Regional Models Into the Decision-Making Process", presented at the American Institute of Planers 61st Annual Conference, New Orleans, Louisiana, September 27-October 1, 1978.

4. Nathanson, Josef, Basic Employment Model, A Model for the Intra-County Location of Basic Employment and Land, BATSC Technical Report 222, Bay Area Transportation Study Commission Berkeley, 1970.

5. U.S. Water Resources Council, OBERS Projections; Economic Activity in the United States, Washington, 1972.

6. Wilson, A.G., Urban and Regional Models in Geography and Planning, John Wiley and Sons, London, England, 1974, pp. 221-243.

ACKNOWLEDGEMENTS

The authors wish to express their thanks to Douglas Detling, Jennifer Wolch, Dennis Wambem, George Hagevik and William Goldner for their review and suggestions on early drafts.